# Seminar Software Quality

## Preliminary meeting

We will start at 13:32

Fabian Leinen (Orga)

Jakob Rott
Roland Würsching
Dr. Markus Schnappinger
Maximilian Jungwirth
Dr. Martin Gruber
Xin Ye
Roman Haas



ПШ

**CQSE** 

# **Software Quality**















Code

Models

**Tests** 











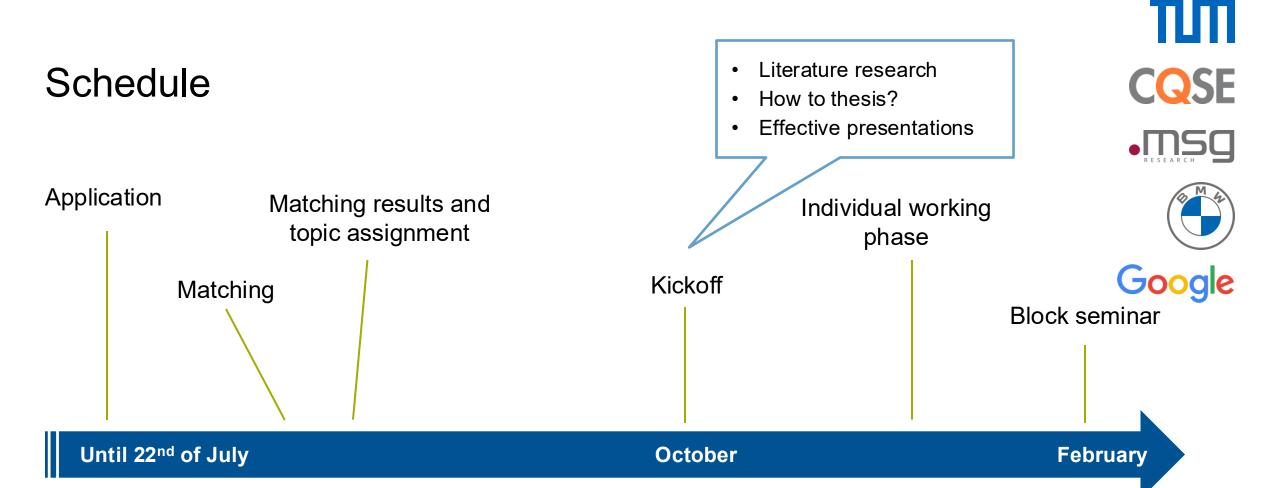
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- Optional: CV + grade report
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## **Thesis**

- Seminar paper: max. 15 pages
- Content: Theory + application of the topic (results, experiences, problems and limitations)
- Initial submission
- Final submission: 1 week after presentation





## **Presentation**



- 20 min + 10 min discussion
- Mandatory dry run (1 week before seminar)

50/50



Questions about the organization?





## **Clone Detection:**

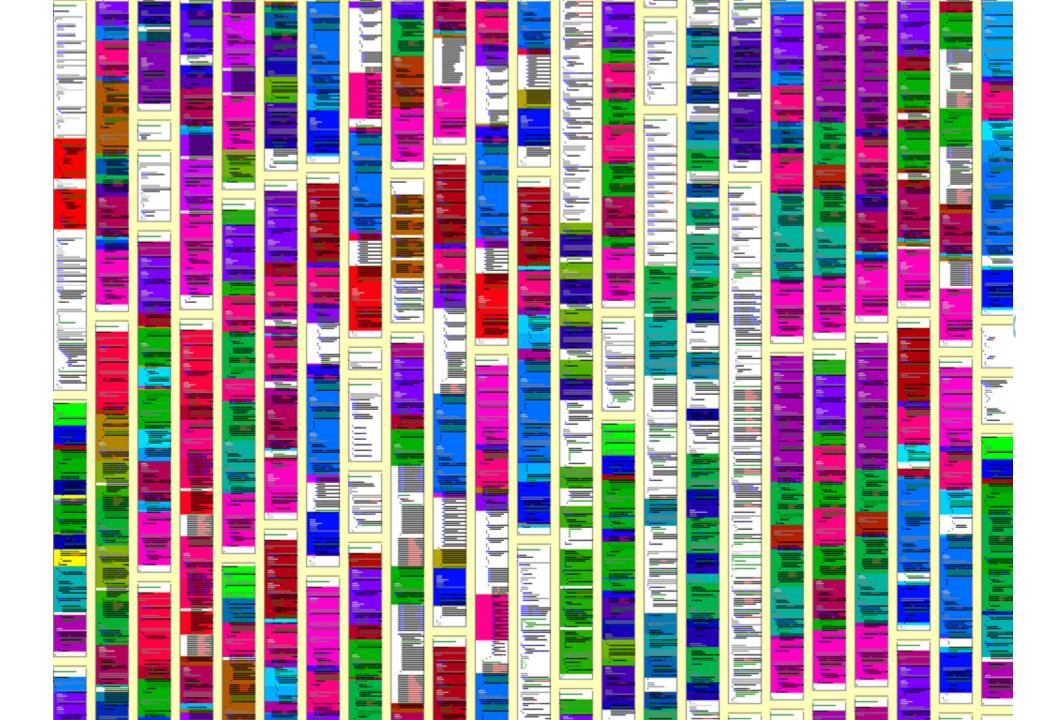
"Where can identical (copied) parts be found in source code?"

```
// Utilities for arrays of elements
public String showElements(ModelElement[] elements, String nomsg) {
   boolean found = false;
   StringBuffer res = new StringBuffer();
   if (elements != null) {
        Index.getInstance().setCurrentRenderer(
            FlatReferenceRenderer.getInstance());
        for (int i = 0; i < elements.length; i++) {
            ModelElement el = elements[i];
            res.append(showElementLink(el)).append(HTML.LINE_BREAK);
            found = true;
        }
        Index.getInstance().resetCurrentRenderer();
    }
    if (!found && nomsg != null && nomsg.length() > 0) {
        res.append(HTML.italics(nomsg));
    }
    return res.toString();
}
```



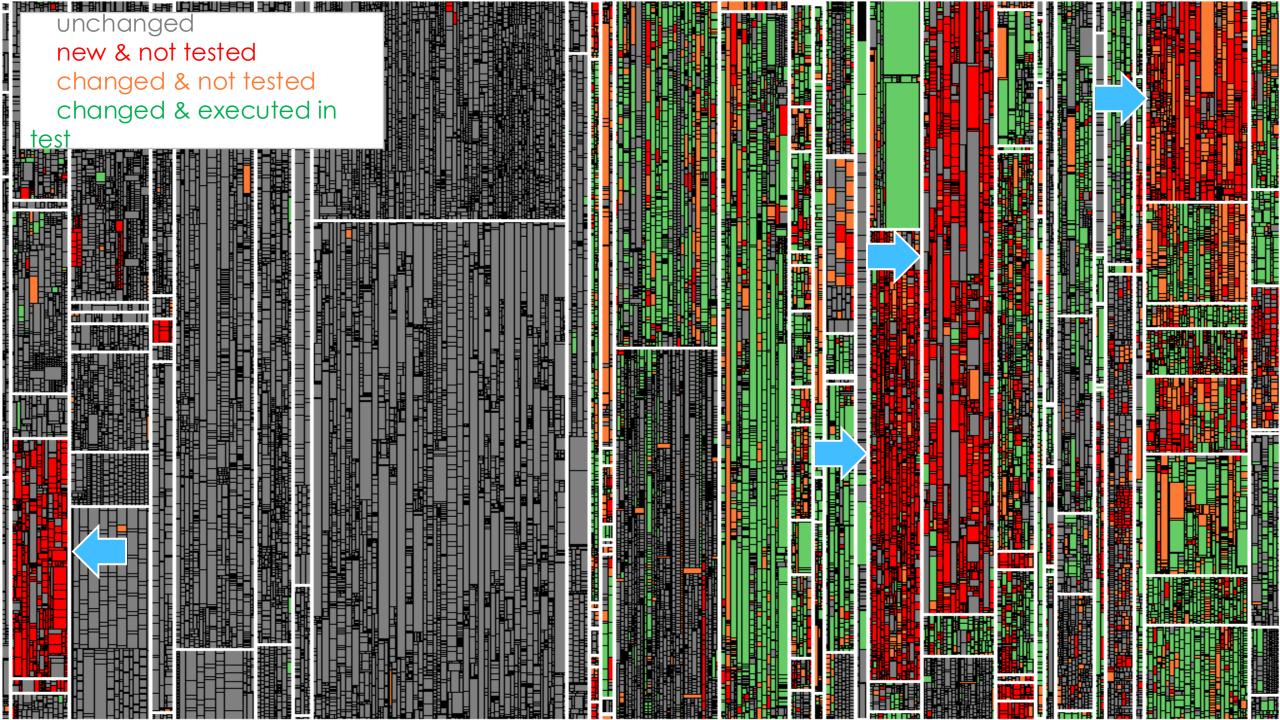


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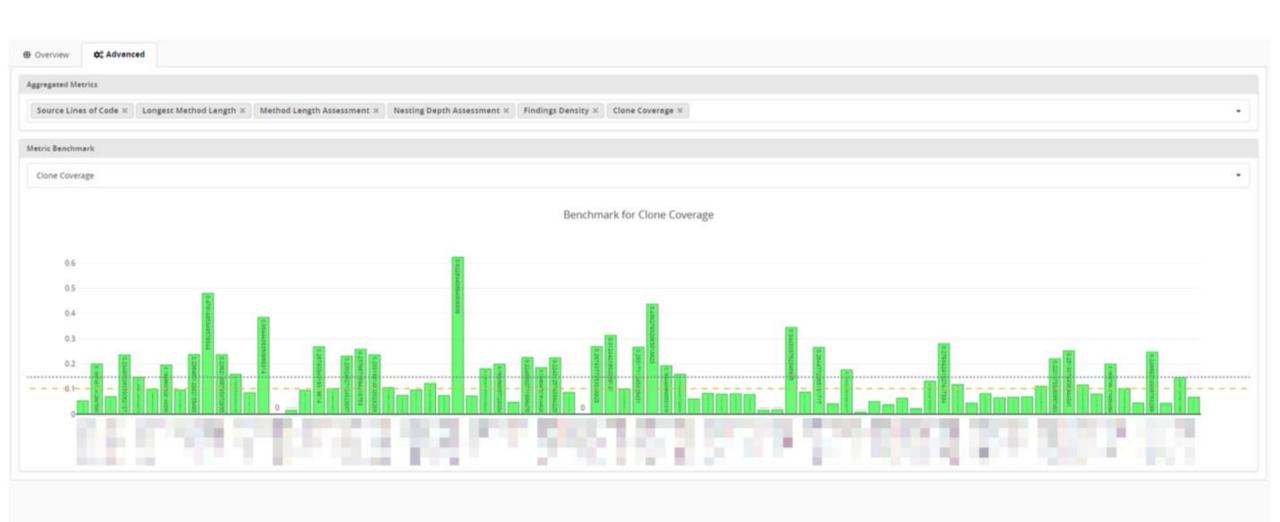


## **Test Gap Analysis**

"Have all changes since the last release been tested?"



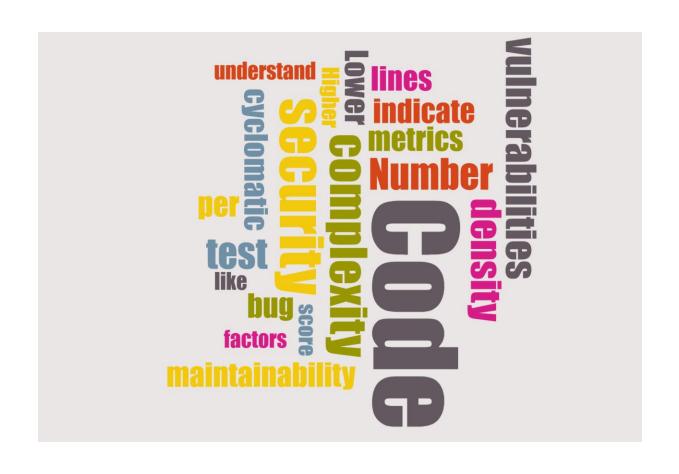
Project -		Final Score	Quality Score	Delta Score	Source Lines of Code	Longest Method Length	Method Length Assessment	Nesting Depth Assessment	Findings Density	Clone Coverage
-	GREEN	0.7340755143920171	0.5077306289966398	0.8095238095238095	0.42857142857142855	0.66666666666666	0.6309523809523809	0.30952380952380953	0.583333333333334	0.833333333333334
	GREEN	0.6621189876776317	0.21990452213909772	0.8095238095238095	0.25	0.047619047619047616	0.4166666666666667	0.23809523809523808	0.38095238095238093	0.2857142857142857
	GREEN	0.5361766327836325	0.6804208168488156	0.4880952380952381	0.5714285714285714	0.44047619047619047	0.5714285714285714	1	0.9880952380952381	0.75
	GREEN	0.6648463747493384	0.23081407042592458	0.8095238095238095	0.4166666666666667	0.2976190476190476	0.13095238095238096	0.13095238095238096	0.20238095238095238	0.2261904761904762
	YELLOW	0.3473775609928538	0.3180816725428438	0.35714285714285715	0.32142857142857145	0.416666666666666	0.5	0.15476190476190477	0.36904761904761907	0.40476190476190477
	YELLOW	0.39419802613174176	0.2553635330983956	0.44047619047619047	0.05952380952380952	0.4880952380952381	0.6190476190476191	0.333333333333333	0.39285714285714285	0.5357142857142857
	GREEN	0.8236932149244094	0.2947728596976374	1	0.14285714285714285	0.23809523809523808	0.4880952380952381	0.6309523809523809	0.30952380952380953	0.32142857142857145
- B	GREEN	0.5437473139473112	0.6749892557892448	0.5	0.6190476190476191	0.833333333333334	0.8214285714285714	0.833333333333334	0.44047619047619047	0.5595238095238095
	GREEN	0.7874932261864153	0.22140147617423267	0.9761904761904762	0.6309523809523809	0.34523809523809523	0.32142857142857145	0.09523809523809523	0.03571428571428571	0.19047619047619047
	GREEN	0.6336629973650774	0.10608056088888057	0.8095238095238095	0.2261904761904762	0.4642857142857143	0.166666666666666	0.03571428571428571	0.05952380952380952	0.023809523809523808
	GREEN	0.6454584818857084	0.15326249897140481	0.8095238095238095	0.7857142857142857	0.07142857142857142	0.10714285714285714	0.023809523809523808	0.2261904761904762	0.20238095238095238
	RED	0.1606877082158262	0.5713222614347334	0.023809523809523808	0.023809523809523808	0.19047619047619047	0.66666666666666	0.7976190476190477	0.7380952380952381	0.38095238095238093
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	RED	0.15503738573196005	0.2987209714992688	0.10714285714285714	0.11904761904761904	0.30952380952380953	0.40476190476190477	0.36904761904761907	0.5714285714285714	0.6190476190476191
-	RED	0.07363249735450234	0.15167284656086646	0.047619047619047616	0.39285714285714285	0.5238095238095238	0.36904761904761907	0.05952380952380952	0.023809523809523808	0.047619047619047616
	YELLOW	0.36510741763059196	0.567572527665225	0.2976190476190476	0.5952380952380952	0.25	0.42857142857142855	0.583333333333334	0.9761904761904762	1
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10000	GREEN	0.752153058971213	0.5800408073134232	0.8095238095238095	0.47619047619047616	0.8452380952380952	0.7619047619047619	0.47619047619047616	0.6071428571428571	0.5833333333333334
	YELLOW	0.19282558282740156	0.12844518845246342	0.21428571428571427	0.21428571428571427	0.05952380952380952	0.047619047619047616	0.0833333333333333	0.66666666666666	0.11904761904761904
-	YELLOW	0.38873567894641003	0.3406570014999257	0.40476190476190477	0.8690476190476191	0.916666666666666	0.44047619047619047	0.19047619047619047	0.15476190476190477	0.05952380952380952











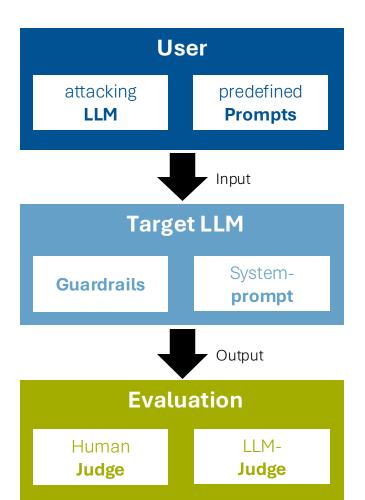












### Your seminar will focus on:

- researching the state-of-the-art considering guardrails and system prompts
- developing a **technical pipeline** to automatically check if an LLM adheres to its defined guardrails and follows its system prompts. To check if the instructions were violated, both humans or other LLMs may act as judges, as well as an ensemble of LLMs
- using the pipeline as the experimental platform **to analyze and compare** different guardrail techniques and their corresponding attack scenarios
- We will refine the exact research questions together based on your interests

Looking forward to working with you!







Step	Description	Expected Result			
1	Launch the browser.	Browser is started.			
2	Click menu → select 'Customize'.	The "Customize" window is opened.			
3	Drag 3 new items from the palette or menu panel and drop them onto the Navigation toolbar.	All items are added onto the Navigation toolbar.			
4	Exit *Customize*.	The changes are applied.			
5	Wait at least 15 seconds, after exiting "Customize", then restart the browser.	Browser is restarted and the previously made customizations are in place.			





- Long test steps
- Misplaced actions
- Inconsistent wording
- etc.









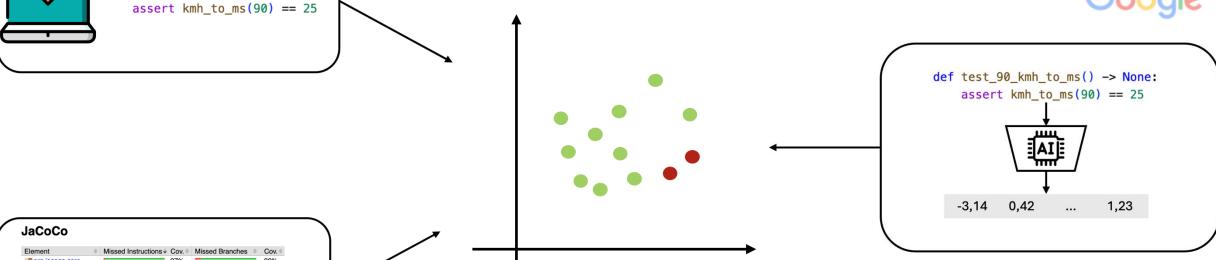
# Using Pre-Trained Embedding Models for Diversity-Based Regression

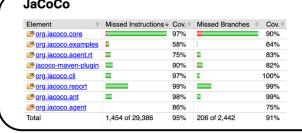








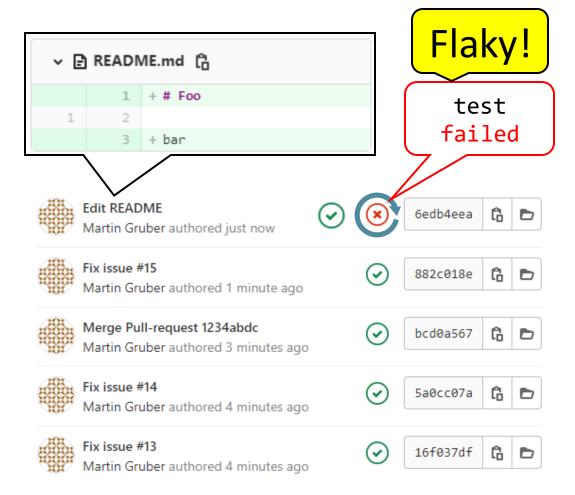


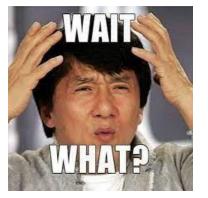


**Test Optimization** 

def test\_90\_kmh\_to\_ms() -> None:

# The Origin of Test Flakiness







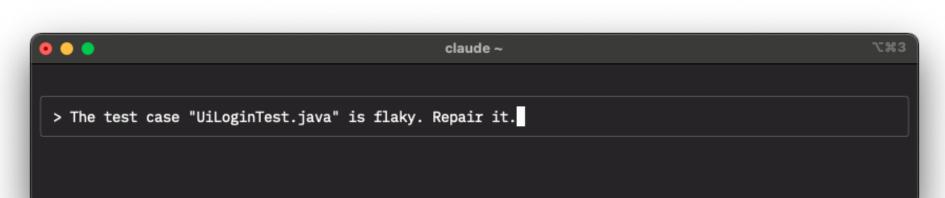








# Flaky Test, Solid Solution? Repairing Flaky Tests Using LLMs







### **Problem:**

The LLM will make changes. Are these changes *good*?

- Does the change effectively repair the flakiness?
- Is the test case still capable of finding regressions?

### **Potential solutions:**

- Extend an approach that finds flaky tests by your automated repair approach
- Use personal projects or from your working position to try out your approach
- Benchmark different products (Claude Code, Cursor, Gemini CLI, ...)









# Evaluating LLM-Generated Test Cases: The Core Problem & Framework

The use of Large Language Models to generate test cases is rapidly increasing, but our ability to evaluate and trust these tests has not kept pace

We will be looking together creating an approach that support the following aspects

- 1. Correctness
- 2. Completeness
- 3. Quality









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